purposes, hardness rather than ductility is desired, and alloys containing rather more than 4 per cent. of copper, or the corresponding amount of manganese, can be employed. The casting of these alloys presents some difficulty, but a considerable number of founders are able to produce castings of this kind with regularity; the secret of their success lies largely in casting the alloy at a suitable temperature, and in the preparation of a mould having a hard and very dry surface. All the alloys of this class undergo a comparatively enormous amount of shrinkage in passing from the totally liquid to the totally solid condition, and unless due allowance is made for this contraction, faulty castings always result.

In the case of the aluminium-zinc alloys, a difficulty of another kind arises; while these alloys are less viscous when molten, and flow into the moulds more freely than the aluminium-copper alloys, they are very weak and brittle while hot, and castings made of these alloys are very apt to crack while cooling if their contraction is opposed to any considerable extent; it is probably on this account that these alloys have acquired the reputation of being "treacherous." They have, on the other hand, been employed with some success for the production of so-called "die castings." These castings are produced by means of metallic moulds, and can be made so accurate that no machining is required even for such objects as screw-threads and certain parts of instruments. On the other hand, these alloys are said to be weak under vibration, but this statement as yet requires confirmation by systematic investigation.

The question of the power of light alloys to resist corrosive influences is one of considerable importance; it has been generally accepted by those accustomed to deal with aluminium and its alloys that the pure metal is much more resistant to corrosion than any of its alloys, and, as regards some of these, this view is undoubtedly correct. The numerous "solders" which have been advocated for jointing aluminium and its alloys all suffer very seriously from this point of view. It must, of course, be borne in mind that aluminium itself has a powerful affinity for oxygen, and only protects itself from rapid atmospheric oxidation by the formation of a very thin coating of oxide on all exposed surfaces; if this coating is ruptured, as, for instance, by friction, continuous oxidation results, and the presence of an alloyed element in the form of a distinct constituent may cause such interruption. Again, the contact of aluminium with another metal, in the case of all those metals usually met with in engineering construction, leads to the formation of galvanic couples, and the consequent rapid corrosion of the aluminium. In this way also an alloyed element may intensify corrosion. On the other hand, it is equally possible that the presence of an alloyed metal may improve the protective coating of oxide formed on the surfaces of the metal, and there is good reason to believe that the presence of copper produces this effect to some extent, while the presence of manganese—as has recently been shown—facilitates the formation of a surface "patina" containing manganese oxide as well as alumina.

Even in the best circumstances, however, the protection of light alloys from corrosion is a most important matter, and this is accentuated by the difficulty of finding a suitable paint or varnish the constituents of which do not act upon aluminium—an action which generally takes the form of an interchange of oxygen between the pigment and the metal. Processes for coating the light alloys with a less corrodible metal, such as copper, tin, zinc, &c., have been tried, but these modes of protection are accompanied by the risk of an increased amount of local corrosion owing to galvanic action, if the metallic coating is anywhere broken through. A more hopeful line of thought is to be found in the development of processes for coating the alloys with an adherent layer of some inert compound of aluminium, much as iron and steel are coated with a layer of phosphate of iron in the "Coslettising" process.

Finally, some reference may be made to the possibilities of the use of magnesium and its alloys for the production of light and strong materials of construction. The fact that magnesium has a specific gravity of only 1·74 at once suggests its use for such a purpose, but the fundamental objection lies in the fact that it is much more corrodible than aluminium, and that therefore the attainment of even moderate durability in its alloys must be a problem of much difficulty. That some solution of this problem may have been found is suggested by the statement recently made that the newest German Zeppelin airship is to be constructed of an alloy known as "Elektron," said to be an alloy of aluminium and magnesium. Its density is stated as being close to 1·7, so that it must clearly consist of magnesium alloyed with only 1 or 2 per cent. of aluminium. No data as to the strength of such an alloy are available, but from the known constitution of the alloys of the aluminium-magnesium system, it appears probable that the addition of aluminium to magnesium in proportions up to 7 or 8 per cent. will materially increase the strength of pure magnesium, but the actual results cannot be predicted; it is, however, probable that pure magnesium is rather weaker than pure aluminium, so that it would be surprising to find in this group an alloy having a density less than 1·8, with a tensile strength above 10 or 12 tons per square inch. Alloys of aluminium with small proportions of magnesium are, it may be mentioned, in somewhat extensive use, particularly for certain parts of scientific instruments, under the name of "magnalium," but these alloys, although somewhat lighter, are not so strong as the best of the aluminium-copper and aluminium-copper-manganese series.

From the foregoing review of the question it will be seen that the problem of light alloys is still far from a satisfactory solution, and that there is a need for further systematic study of the alloys of the lighter metals. WALTER ROSENHAIN.

GREEK ARCHÆOLOGY.[1]

THE "Annual of the British School at Athens" still remains of the somewhat unwieldy size that it has assumed of late years. A return to the more convenient bulk of, say, vol. viii. would be welcomed by the reader; yet it cannot be said of any of the articles in vol. xiv. that any part of them might profitably have been excised. Only the fourth instalment of Dr. Mackenzie's work on "Cretan Palaces" seems rather too long. Still, no doubt the various questions raised by Dr. Dörpfeld's criticism of Dr. Mackenzie's former articles, Dr. Noack's work on Cretan buildings, and the discoveries of Neolithic prototypes of the "Homeric" palace in Thessaly, needed exhaustive treatment. So we are compelled to postpone reading Dr. Mackenzie's views on the relations of the Homeric house to the Cretan palaces until next year.

The director of the school and his assistants continue their account of the discoveries at Sparta, which have conferred such lustre upon British archæological work during the last three years. Few believed that excavations at Sparta would prove so interesting.

1 "The Annual of the British School at Athens." Vol. xiv. (Session 1907–8.) Pp. x+468; 15 plates. (London: Macmillan and Co., Ltd., 1909.) Price 25s. net.

We assumed too hastily that the rude, countrified Lacedæmon of the prejudiced and tendencious Athenian historians whom we are taught at school to accept as infallible would yield little or nothing of interest to our spades. Yet the excavations of Messrs. Bosanquet and Dawkins and their helpers have shown that early Sparta was in no way behind other Greek cities in art and civilisation; and we remember that in Homeric days Lacedæmon was a lordly house of princes, while Athens was nothing at all. The excavations of 1909, which are not treated in this volume of the "Annual," have revealed to us the scanty remains of the old Mycenæan civilisation of Sparta, at the Menelaïon, the heroön of Menelaos, on a hill some two miles distant from Sparta itself, on the opposite bank of the Eurotas. We await with interest the publication in the next "Annual" of these discoveries. The volume before us deals chiefly with the continued excavations of the temple of Artemis Orthia, which have resulted in the discovery of the most primitive shrine on the site, which dates from the eighth century B.C. Geometric pottery found beneath its floor shows that the place was sacred at an earlier date, but no Mycenæan sherds prove a history going back into the Bronze age. The geometric sherds lie on virgin soil, and the sanctuary was evidently a new one, established by the Dorians.

The great quantity of pottery found has enabled Mr. Droop to construct a scheme of the development of Laconian pottery from its first stage, immediately succeeding the Geometric, to its latest. The identity of the Laconian style with that hitherto known as "Cyrenian" is proved.

Prehistoric archæology is represented in this volume by two articles by authors who disagree with one another. M. Vassits, the curator of the Belgrade Museum, writes a somewhat inconclusive article on "South-eastern Elements in Prehistoric Servia," in which he claims, reasonably enough, that the Ægean culture must have sent forth a stream of influence which passed up the Vardar valley into the Danubian basin, but does not bring forward much positive evidence of importance to confirm this probability. Messrs. Wace, Droop, and Thompson contribute an account of their very important excavations in Thessaly, which have put into their proper perspective the previous discoveries of Sotiriadis in Bœotia, and Tsountas in Thessaly, and have shown that in early times northern Greece possessed a peculiar art and culture of its own which was very little affected by Ægean influence. We say "very little"; the authors would say "not at all," but without much probability. Mr. Wace and his colleagues have discovered that in northern Greece a Neolithic culture continued to exist until long after the Ægean had reached the full flower of the Bronze age, and that the Thessalian contemporaries of the Minoan Cretans were stone-using barbarians. Then, brushing aside the few traces of Ægean influence on this barbaric culture (such as the rude spiral ornament in the Dimini pottery), they assume that the North-Greek and Ægean contemporary cultures had no connection with one another, and were absolutely independent, not only in origin, but until suddenly the higher culture broke down the lower in the latest Minoan age. It is obvious, however, that this is impossible. The Ægeans were active seamen, and it is incredible that Ægean influence should not have affected the Thessalians, conservative though they were, from the beginning; and, at the same time, that the Ægean influence should not have affected the north coast of the Ægean Sea and have penetrated up the Vardar valley, as M. Vassits says it did, and have greatly influenced the Danubian Bronze-Age civilisation. We believe that the independent North-Greek Neolithic and Chalcolithic "culture" was no bar to this, and that itself it was much more affected by the Minoan culture than its discoverers believe. For us, then, M. Vassits and Mr. Wace are both right.

The great importance of the Thessalian discoveries for the history of the origin of European civilisations is evident. It has never seemed to the present writer probable that the changes from the age of Stone to that of Metal, and from the age of Bronze to that of Iron, each necessarily took place at about the same time all over the European and Mediterranean world; iron, for instance, seems certainly to have been used sporadically by the Egyptians as early as the time of the fourth and sixth dynasties, about 3000 B.C., whereas even in southern Europe it does not appear much before 1000 B.C.; and now we see the same thing in this case of the continued use of stone, for long exclusively, by a large community in northern Greece down nearly to 1300 or 1200 B.C., and contemporaneously with the existence, but two hundred miles off, of the head centre of the splendid Bronze-age civilisation of Minoan Crete. We are again reminded that, though nature *nihil facit per saltum,* human activity does progress in precisely this haphazard way. Our archæologists, too much under the influence of the professors of natural science, have assumed that the evolution of human progress was far more even and equable than actually was the case.

The Greek sculpture of the later period takes up less space in this year's "Annual" than in that of last year; there is only one short article by Mr. Wace on an interesting Pergamene head found at Sparta.

Prof. Burrows and Mr. Ure contribute an account of their excavations in tombs at Rhitsóna (Mykalessos), which have produced large quantities of pottery of the classical period; and there are interesting articles by Mr. Hasluck on the topography of Laconia, and by Mr. Hogarth on Hierapolis Syriæ, the ancient sanctuary between Aleppo and the Euphrates, otherwise called Bambyke or Mabog, the modern Mambij. Mr. Hogarth publishes several fragmentary Greek and Latin inscriptions and graffiti of Roman days from this ancient holy place. H. R. HALL.

GOATS AND MALTA FEVER.

A QUESTION asked in the House of Commons on June 13 illustrates the desirability of members of Parliament becoming familiar to some extent with scientific facts before concerning themselves with subjects in which such facts are involved.

The question was in regard to the part played by the goat in the spread of Malta fever, and arose out of a misreading of the evidence given before the Royal Commission on Vivisection (Q. 14,242). The question asked was to the effect that, seeing no goats had been infected by the alleged Malta-fever germ, and that it did not give rise to any ill-health or fever in these animals, why spend money on any inquiry regarding the part played by goats in Malta fever?

The evidence given before the Royal Commission was that the goats did suffer from this disease, that the micro-organism did multiply in their bodies, but that it did not give rise to any appearance of ill-health or rise in temperature. It is this that makes the goat so dangerous. If Malta fever caused high fever and the other symptoms of a severe disease in the goat, as it does in man, the goat would probably cease to be a danger. The animal would be confined to its stable, and its milk would run dry. As it is, the goat which acts as a source of the virus of Malta fever continues to accompany the herd into the town or village, appears the picture of health, and secretes quite as much milk as its harmless neighbours.